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U. S. DEPARTMENT OF
AGRICULTURE
FARMERS' BULLETIN No. 1517

LOBLOLLY
PINE PRIMER



WHY GROW PINES?

BECAUSE—

PINES will grow well on lands too poor for other crops.

PINES are the most profitable crop that can be grown on some of the land on farms.

PINE timber the country over is rapidly becoming depleted and is rapidly increasing in value.

PINES grow faster than most other kinds of trees and yield more profit per acre.

PINE timber is more readily marketable than that of any other kind of trees.

PINES are easily regenerated, both by natural means following right cutting and by artificial means of sowing the seed or setting out small seedling trees.

PINES made to grow on worn-out, broken, wet, steep, sandy, and inaccessible lands on farms would mean millions of acres of idle lands brought back into profitable use.

PINE timberland on your farm, well set with trees and properly protected from fire, means an asset of increasing value—a bank account for your sons' and daughters' education, and relief in times of emergency.

COVER PICTURE—PERMANENT FARM WOODLAND

Loblolly pine grown on farm timberland that can never be cleared. In 1797 a South Carolina planter, Joannes De la Howe, bequeathed a farm of 1,700 acres to the State for the purpose of maintaining a school in which agriculture was to be taught, and specified that 1,000 acres should always remain in timber. The timberland has been protected from fire and no trees have been cut except when fully ripe.

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LOBLOLLY PINE PRIMER

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GROWING LOBLOLLY PINE AS A CROP

LOBLOLLY PINE—known also as old field pine and short-leaf pine—is one of the South's greatest natural resources. It grows rapidly, makes a readily salable product, is easily propagated, and is naturally adapted to very large areas in nearly all of the Southern States. Because of its profitableness as a crop, it is one of the most important as well as one of the most widely known forest trees in the country.

The pines, the world over, are rapidly becoming scarce. This is mainly because their wood works easily and is adapted to many uses and because fires are more frequent on pine lands and kill out the pines much more extensively than they do the hardwoods.

The time has arrived when capital is seeking investment in the South in pine-growing lands because they may be regarded as a safe long-time investment, with reasonable assurance of a steady return over an extended period. In an increasing degree, farm owners are protecting the less tillable parts of their lands from fire and taking other means of growing timber as a crop. They are realizing that, on the broken, wet, and sandy parts of their farms not adapted for agriculture and needed for no other use for a generation or more, timber is profitable to grow and will bring in a larger net return than any other crop.

The increasing interest in the growing of pine timber as a crop has resulted in this bulletin. Some of the subjects on which information is given are the rate of growth, yield of timber per acre at different ages, sources of damage and injury and how to combat them, thinning and cutting trees, methods of reforesting denuded lands, and the profit to be expected from growing loblolly pine as a crop.

THE TREE AND WHERE IT IS FOUND

How can loblolly pine be recognized?

The loblolly pine may be distinguished from the several other pines by its having three leaves, or "straws," in each cluster, deeply divided

and rough bark, and very prickly burrs, which when closed are about the size of a duck's egg. The leaves vary mostly from 5 to 8 inches in length and the burrs from 3 to 5 inches (fig. 1). The loblolly heals its wounds with pitch or "gum," but does not produce gum in paying quantities, because the faces dry up in a day or two. In periods of extra high prices for naval stores, loblolly trees are often worked for gum, but usually with little profit.

Loblolly pine is widely known over the South as "old field," "short-leaf," and sometimes as "black" pine. The term "lowland

short leaf" might be applied to it, because it is a tree of the lower lands. In many parts of the South the true short leaf, or upland, or short-leaf yellow pine, is found mixed with the loblolly pine. The loblolly is generally larger in size at the same age, has heavier and longer branches, and longer leaves (straws) of a bluish green color.

Are there other pines that might be mistaken for loblolly?

Yes. From Virginia to Florida in the coastal belt occurs the pond, pocosin, or black pine. The leaves are somewhat similar, but the burrs are very short and broad at the base and not so prickly as those of the loblolly pine. The tree generally has a more crooked trunk and the timber is generally of relatively poorer grade.

The slash pine (*Pinus caribaea*), particularly in its younger stages, has been widely mistaken for loblolly. Slash pine is native in the coastal plain belt in the southern part of South Carolina, southern Georgia, Florida, the southern parts of Alabama and Mississippi, and southeast-



FIG. 1.—The rough bark, 6-inch leaves (straws), and 3-inch burrs aid in identifying loblolly pine and in separating it from the true short-leaf yellow pine

ern Louisiana. Slash pine has longer, much greener, and more glossy leaves (straws) than loblolly, but individual trees of low vigor resemble the loblolly.

Where is loblolly pine found?

Loblolly pine grows naturally from southern Delaware and eastern Maryland over the coastal plain and lower Piedmont sections south and west to eastern Texas and southern Arkansas (fig. 2). Of the total amount of second-growth pine cut throughout the Southern States and used for firewood, paper pulp wood, poles, lumber, and other uses, loblolly contributes probably as much as all the other kinds of pine added together.

Large areas where long-leaf pine formed the bulk of the original forests have reseeded to loblolly pine following logging. Some of the reasons for this are that loblolly produces seeds more abundantly, the seeds are much smaller and therefore fly farther in the wind, and the young trees are not generally attacked or injured by "razorback" hogs as are young long-leaf pines.

In the lower and middle Piedmont sections, loblolly pine is commonly found along with the hill, or true, short-leaf yellow pine. Loblolly forms the bulk of the present, or second-growth, pine for-

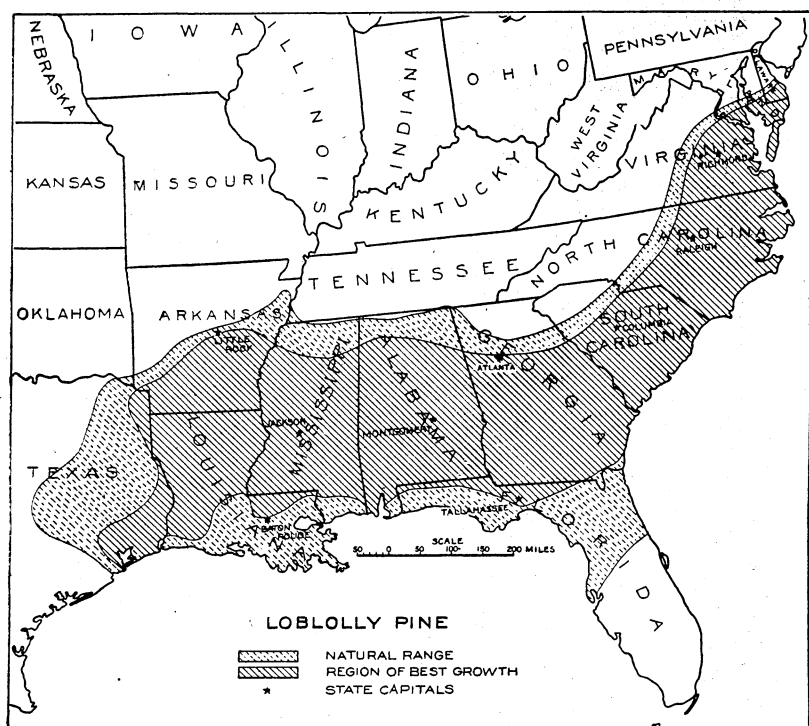


FIG. 2.—This map shows by diagonal lines where loblolly is found naturally. In the inner portion of the region, crossed by solid diagonal lines and inclosed within a heavy line, loblolly grows well and is generally one of the most profitable pines to grow as a timber crop

ests in eastern Maryland, southeastern Virginia, the eastern third of North Carolina, the eastern or southern half of South Carolina, the middle portions of Georgia, Alabama and Mississippi, southeastern Arkansas, and generally over the lowland portions of northern Louisiana and southeastern Texas. In the southern portions of Georgia, Alabama, and Mississippi, loblolly is abundant in many localities, and in others is scattered among other kinds of pines, mostly in the silt soils along fresh-water streams. In Florida it occurs in the northern part, and in the hilly section around Tallahassee.

GROWTH OF THE TREE

How can the age of a tree that has been cut be found out?

To find the age of a tree count the rings of growth on the stump, and add the number of years required by the tree when it was young to reach the height of the stump. For example, about two years should be added to the age of a loblolly pine as found by counting the annual rings of growth on a stump 12 to 15 inches in height.

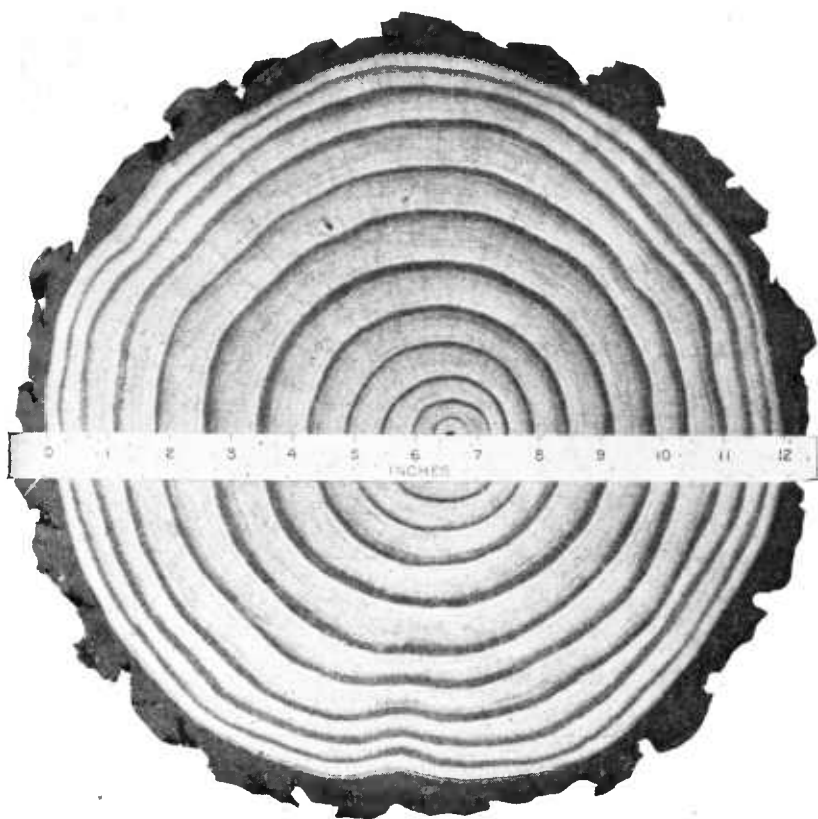


FIG. 3.—A growth of 12 inches in diameter, inside the bark, in 12 years. This shows the extremely fast growth of loblolly pine under favorable conditions

How fast does loblolly pine grow?

The people of the South generally have a good idea of the rapid growth of loblolly, or oldfield, pine, and the early age at which the saplings reach merchantable size. The loblolly pine tree shown in cross-section in Figure 3 grew to be 12 inches in diameter, measured inside the bark, in 12 years. The tree had excellent conditions for growing. A 12-year-old tree, growing in Berkeley County, S. C., when cut at 6 inches above the ground, measured 13 inches in diameter not including the bark. The top of the first 16-foot log measured a little more than 8 inches across. The tree was 49 feet in height, so

it had made an average growth in height of more than 4-feet a year. This is about the fastest or maximum growth.

Loblolly is a faster growing pine than either the long-leaf or the true short-leaf yellow pine. It appears from available information that during the first 20 years or so slash pine grows faster, but at ages from about 20 years up to 60 or 80 years loblolly apparently beats all other southern pines.

If grown in fairly open stands, where there is ample space between the trees for the branches to expand and the roots to spread without interference from those of the next trees, loblolly trees at 30 years of age, as shown in Table 1, might be expected to average about 14.2 inches in diameter on good soil, 10.6 inches on average soil, and 9.1 inches on poor soil. The same aged trees, if grown in crowded stands, would likely average about 10.4 inches on good land, 8.8 inches on average land, and 8.2 on poor land.

As to the height of the trees at 30 years old, on good soil they should average about 75 feet, on average soil about 61 feet, and on poor soil about 47 feet.

In all these points of measurement, there will be much variation in the diameters of individual trees. The figures given show about the averages to be expected. The figures under "average land" are usually the best ones to go by, where the quality of the land is not definitely known.

TABLE 1.—Growth of loblolly pine, showing the average height and diameter of trees at various ages and on different qualities of land and the number of trees per acre

Age of trees in the stand (years)	Height			Diameter of the larger (or dominant) trees in open-grown stands ¹			Diameter of the larger (or dominant) trees in crowded stands			Number of trees 6 inches and over in diameter on an acre ²
	Good land	Average land	Poor land	Good land	Average land	Poor land	Good land	Average land	Poor land	
	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	
20.....	56	44	32	10.8	8.2	6.9	7.6	6.5	6.2	
25.....	66	53	40	12.7	9.4	8.0	9.1	7.8	7.2	260
30.....	75	61	47	14.2	10.6	9.1	10.4	8.8	8.2	270
35.....	82	68	53	15.6	11.9	10.1	11.9	9.9	9.2	250
40.....	90	74	59	16.9	13.0	11.1	13.2	10.8	10.0	215
45.....	94	79	65	18.2	14.2	12.0	14.5	11.9	11.0	180
50.....	99	84	70	19.2	15.2	12.8	15.7	12.8	11.7	150
55.....	103	88	74	20.2	16.2	13.6	16.6	13.7	12.4	130
60.....	106	91	77	21.0	16.9	14.3	17.4	14.5	13.1	120
65.....	108	94	81	21.9	17.7	15.0	18.2	15.2	13.7	110
70.....	110	96	83	22.6	18.4	15.7	18.8	15.9	14.3	100

¹ Diameters are measured outside the bark, at a height of 4½ feet above the ground, or breast high.

² The trees on the better qualities of land are fewer and larger in diameter; the number on the poorer lands is greater and the trees are smaller in diameter.

How large do loblolly pines grow?

Individual trees of the loblolly pine have been known to reach heights up to 170 feet, and diameters measured outside the bark at breast-height (4½ feet above the ground) of 65 to 75 inches. The largest known individual pine trees of any kind found in the South have been loblolly, very often known as "rosemary" pines, and found growing in deep alluvial soils of bottoms or fresh shallow swamps. One such tree, at an age of 154 years, was 148 feet in height, 60

inches across the stump (inside the bark), and contained about 5,500 board feet of saw timber.

What factors influence the rate of growth?

The depth and grade of the soil and particularly its ability to hold moisture during the growing season, greatly affect the rate of growth of the trees. Old fields have better soil conditions than original forest lands and consequently favor more rapid development of trees. Generally, the better the land the larger the trees will be at any age and, as a result, the fewer trees will be needed per acre to stock the land fully.



FIG. 4.—A. "Bush" pines like these result from not enough pine seed to stock the land fully with trees or from the killing out of many pines by fires. Many of the old fields and cut-over lands of recent years are growing up to such limby and knotty "bush" pines. B. These pines have long, clean stems. They grow in a well-stocked stand of trees.

Other factors which affect the rate of growth are forest fires, the age of the tree, the degree of crowding on the land, and the temperature and rainfall. The effect of forest fires is discussed on page 23.

What are "bush" and "bull" pines?

They are pine trees that have grown singly in open spaces, as a result of which they have many large branches often reaching nearly to the ground. The same trees, if they had grown in a thick, or crowded stand, would look very different, for they would have clean, slender, and usually taller trunks. Figure 4 illustrates the two kinds of growth. Bush pines make only cordwood or very low-grade lumber. Of all the southern pines loblolly is one of the worst offenders about taking the form of bush trees. It needs crowding to a good degree.

How can trees be grown with tall, clean trunks?

Trees are much like corn or okra. If they are crowded, the stems are slender and relatively clear of leaves or branches. Sometimes a single tree is left standing after the others have been cut. Its trunk is usually long, straight, and free of branches for over half its length (fig. 5). To get such trees, the young pines should be grown in thick or well-stocked stands.

ESTIMATING THE LUMBER IN TREES

How much saw timber can be cut from loblolly trees of different sizes?

It is possible to estimate roughly the number of board feet of saw timber in standing trees. The two things necessary to know are the diameter of the tree outside the bark at breast height ($4\frac{1}{2}$ feet above the ground) and either the number of 16-foot cuts in the tree, or the approximate total height. For example, Table 2 shows that a tree measuring 14 inches in diameter outside the bark (at breast height, or $4\frac{1}{2}$ feet above the ground) and having three 16-foot logs, if sound, should cut out 140 board feet; if it measures 16 inches in diameter and has four 16-foot logs it should cut out 260 board feet. This quantity can not be obtained by careless logging and sawing, or from a badly formed tree.

TABLE 2.—The amount of lumber in board feet that can be cut from loblolly pine trees of different sizes, depending upon the diameter and the number of 16-foot cuts in the tree

Diameter of trees at $4\frac{1}{2}$ feet above ground (inches)	Number of 16-foot logs in the tree							
	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Contents of tree in board feet							
7.....	20	30	45	75	90	110	140	170
8.....	25	35	50	75	90	110	140	170
9.....	30	40	55	75	90	110	140	170
10.....	30	45	60	75	90	110	140	170
11.....	30	45	60	75	90	110	140	170
12.....	60	80	105	125	150	170	200	230
13.....	70	95	120	150	170	200	230	265
14.....	110	140	170	200	230	265	305	345
15.....	120	160	195	230	265	305	345	390
16.....	180	220	260	305	345	390	435	480
17.....	205	245	290	330	380	435	480	530
18.....	270	330	380	435	480	530	580	630
19.....	365	420	480	530	580	630	680	730
20.....	405	460	510	560	610	660	710	760

This represents the mill cut by careful logging and saw-milling, on sound and reasonably straight logs.

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FIG. 5.—A veteran loblolly pine, perhaps 100 years old. The bark is broken into short and wide "plates." In some parts of the South the large loblolly pines like this growing in moist land are known as "rosemary" pines

A loblolly pine (as shown in Table 3), 70 feet in height and 12 inches in diameter, contains about 130 board feet of 1-inch boards, but a tree of the same height and 18 inches in diameter contains 335 board feet. Both tables assume that the logs are straight and sound, and cut with a circular saw ($\frac{1}{4}$ -inch saw kerf); that the tree is cut with a stump 12 inches high; and that the trunk is used down to a small top log. The quantity that is actually sawed out depends, of course, on the way the tree is bucked up into logs and the way the logs are sawed. These figures allow for the necessary waste in cutting trees and sawing the logs.

It will be noted that an increase of an inch in the diameter of the tree makes a considerable increase in the contents of the tree, especially in trees of the larger sizes. Likewise for each increase of 10 feet in height there is an even greater rate of increase in contents of the trees, except for trees of the very small sizes.

There is record of an "old big loblolly that grew in the ditch" in Arkansas, which cut seven 12-foot logs scaling 1,728, 1,452, 1,323, 1,200, 1,141, 972, and 926 feet respectively, or a total of 8,742 board feet.

TABLE 3.—*The amount of saw timber contained in loblolly pine trees of different sizes, depending upon the diameter and the total height of the tree*

Diameter of tree, outside bark at breast height (inches)	Total height of the tree in feet							
	40	50	60	70	80	90	100	110
	Contents of tree in board feet							
7.....	15	20	25	30	35	-----	-----	-----
8.....	20	25	35	45	50	60	-----	-----
9.....	25	35	45	60	70	80	-----	-----
10.....	35	50	65	80	95	110	-----	-----
11.....	45	65	85	100	120	140	-----	-----
12.....	55	80	100	130	150	175	200	225
13.....	-----	95	125	155	185	215	250	280
14.....	-----	110	150	185	225	260	300	335
15.....	-----	-----	175	220	260	305	350	390
16.....	-----	-----	205	255	300	350	400	445
17.....	-----	-----	240	295	350	405	460	515
18.....	-----	-----	270	335	400	460	520	580
19.....	-----	-----	-----	380	450	515	580	650
20.....	-----	-----	-----	425	500	570	645	720
21.....	-----	-----	-----	465	550	630	710	790
22.....	-----	-----	-----	515	605	695	785	875
23.....	-----	-----	-----	565	665	765	860	960
24.....	-----	-----	-----	620	730	835	940	1,045

This represents the mill cut by careful logging and saw-milling, on sound and reasonably straight trees.

SCALING LOGS

Does it matter by what log rule timber is scaled?

Yes, there is a great difference in the amount of timber.

What rule is commonly used in the Southern States?

The Doyle rule is very generally used, and sometimes the Doyle-Scribner rule. The latter rule is a combination of the two rules, comprising the Doyle up to 27 inches and the Scribner rule above that point, beginning with 28 inches. The Scribner rule gives a

less scale than the Doyle rule for all sizes of logs measuring 28 inches and over in diameter.

Is the Doyle rule satisfactory in showing the true contents of logs?

The Doyle rule, although in common use in the South, is unfair to the seller for logs below about 28 inches in diameter. In the early days of large and cheap virgin timber, when narrow and knotty boards were worthless, it was fairly satisfactory; but for sealing small-sized timber, such as second-growth southern pine, it gives such small volumes for small logs as to make it unsatisfactory. On the national forests, the Scribner rule (in the decimal C form) is standard. It is more fair than the Doyle rule for small logs, but reasonably careful sawing should result in obtaining from 10 to 20 per cent more lumber than even this rule gives for second-growth timber of good form.

For small timber, such as second-growth pine, the international log rule (Table 4) gives log volumes which are very close to what can be sawed out by using good methods. Careless sawing will give a lower volume of square-edged boards than the logs scale by this rule, so that it gives the mill man a chance to test his own efficiency in this respect. Producers of small logs will benefit when this or some equally close rule has come into general use. The sale of logs by the international rule or by the mill tally is recommended.

As a comparison, a log measuring 10 inches in diameter inside the bark at the small end and 16 feet long when carefully sawed with a circular saw of ordinary thickness ($\frac{1}{4}$ -inch kerf) should, by the international rule, turn out 64 board feet. The same log scaled by the Doyle rule shows 36 board feet, or only about one-half the amount that can be actually sawed and that is credited by the international rule.

TABLE 4.—The contents of logs, in board feet, scaled by the international log rule (using saw cutting $\frac{1}{4}$ -inch kerf)

Diameter at top end of log (inches)	Length of log in feet						
	8	10	12	14	16	18	20
	Contents in board feet						
6.....	7	10	13	16	19	23	27
7.....	12	15	19	24	28	33	39
8.....	16	21	27	33	39	45	52
9.....	23	29	36	43	51	59	68
10.....	29	37	45	54	64	75	86
11.....	36	46	57	68	80	92	105
12.....	44	57	70	83	97	111	127
13.....	52	68	83	100	116	133	151
14.....	62	80	98	117	136	156	176
15.....	73	94	114	136	157	180	204
16.....	84	108	131	156	181	207	233
17.....	96	123	149	177	205	235	265
18.....	110	139	169	201	232	265	299
19.....	123	156	190	225	261	297	335
20.....	138	174	212	251	290	330	372
21.....	152	193	234	279	321	366	412
22.....	168	214	259	307	354	404	453
23.....	186	235	285	337	388	442	497
24.....	203	257	311	367	424	481	542

The contents given are for sound straight logs, carefully sawed so as to use all the timber in the log.

Is there any further available information on how to measure and how to market timber?

Some of the State forestry departments and State colleges of agriculture have publications on this subject. The United States Department of Agriculture, upon request, will furnish copies of Farmers' Bulletin 1210, "Measuring and Marketing Farm Timber."

TIMBER PRODUCTION PER ACRE

How much saw timber will an acre of loblolly pine produce at different ages?

An acre well set in loblolly pine and protected from fire will average a growth of from 300 to nearly 1,000 board feet of saw timber yearly. The production per acre depends, as with other

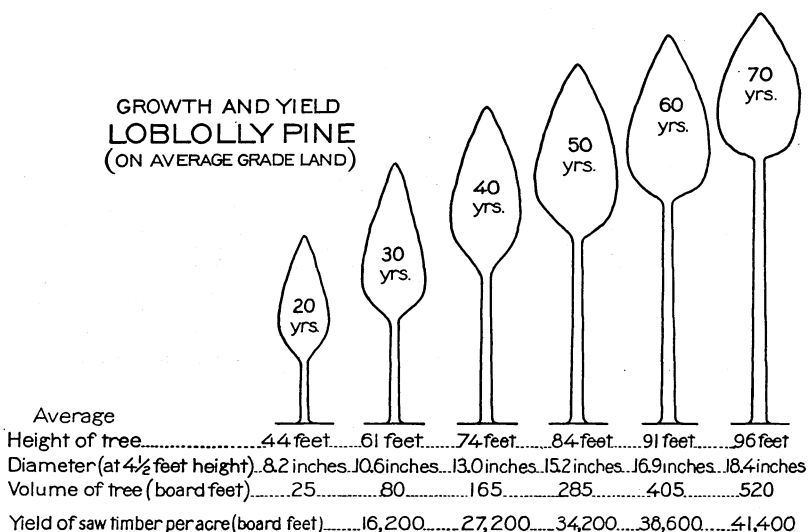


FIG. 6.—The average size of loblolly pine trees, their contents in board feet, and the amount of timber per acre at different ages

crops grown from the soil, upon the character of the soil, the age of the trees, and the number of trees on the ground.

The amounts of timber per acre shown in Table 5 are based upon the measurements of samples of many well-stocked stands of different ages. The figures in the first four columns of the table show for different ages the amount of timber per acre that might be sawed out by careful methods in the woods and at the sawmill, taking all trees measuring 6 inches in diameter and over. For example, at 30 years old, a well-stocked stand, protected from fire, on poor land should contain about 7,300 board feet, on average grade land about 16,200 (fig. 6), and on good quality land about 29,100 board feet. This is an average yearly rate of growth of about 240 board feet on poor land, 540 board feet on average land, and 970 board feet on good land. Individual stands have been measured that had averaged as much as 1,800 board feet a year, for 32 years, and conversely on poor sites that made less than 200 board feet yearly.

The loblolly pine stands, as they are commonly growing, are mostly not fully stocked with trees or are often overstocked in places. Fire has repeatedly burned over most of the pine lands, injuring the growth of all the trees and often killing trees in patches. Thus the timber stands are not producing their greatest possible growth. In fact, very much land is growing timber at the rate of only one-third or less of its capacity.

The value of an acre of loblolly pine grown as a crop will be found on page 22.

TABLE 5.—Amount of saw timber per acre, measured in board feet, grown by loblolly pine in well set, or medium dense, stands, protected from fire and rightly thinned¹

Age of trees (years)	Mill tally, or actual cut			Logs scaled by the Doyle-Scribner rule		
	Good land	Average land	Poor land	Good land	Average land	Poor land
	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
20	14, 700			800		
25	22, 600	9, 400		8, 600	1, 900	
30	29, 100	16, 200	7, 300	16, 100	6, 800	650
35	34, 200	22, 100	12, 800	22, 600	11, 800	3, 200
40	38, 500	27, 200	17, 200	28, 400	16, 400	6, 000
45	42, 200	31, 200	20, 500	32, 900	20, 400	9, 400
50	45, 000	34, 200	23, 200	36, 700	23, 700	12, 400
55	47, 300	36, 600	25, 400	39, 700	26, 200	14, 500
60	49, 200	38, 600	27, 200	41, 800	28, 100	16, 200
65	50, 800	40, 100	28, 500	43, 000	29, 600	17, 700
70	52, 100	41, 400	29, 600	43, 600	30, 600	18, 900

¹ From all trees measuring 6 inches and over in diameter at breast height, or 4½ feet above ground. The product is boards 1-inch thick, cut with a circular cut, ¼-inch saw kerf.

THINNING PINES

What effect does thinning have upon tree growth?

It stimulates rapid growth in diameter of the trees that are left. If the trees are overcrowded at the start, thinning increases growth in height. It develops larger-sized trees at a given age and thereby usually increases the money returns.

An acre can produce just so much wood material in a given number of years. By right thinning the new wood is made to grow on fewer trees but each of larger size (fig. 7). A case where thinning might not be practicable is in the growing of trees for firewood where size of the individual tree does not count.

When should pine trees be thinned out?

Young pines should grow up thick on the ground, in order to develop long, clean, straight stems. There will take place a natural thinning caused by the better-rooted and stronger-growing trees getting ahead and crowding out the weaker trees (fig. 8). Frequently, owners of young pines are found trying to thin out thickets of pine saplings an inch or two in diameter and from 5 to 10 years old, with a view of improving their growth. This is expensive, for if the stands are overthinned the upward growth, which is very desirable in young timber, is probably not so rapid and the total production of timber per acre is lessened.

The time to begin thinning, as a rule, appears to be when the trees reach diameters of 3 to 6 inches. The heights will then usually be from 25 to 35 feet and the ages from 12 to 15 years. Another general rule is to wait until the material cut in the thinning will pay for the cost of the operation. Nowadays when small timber is often of good value for pulp wood, or firewood, poles, or posts (for creosote treatment), the first thinning can be made earlier than it could formerly.



FIG. 7.—Thinning of overworked loblolly pines is very profitable. In the 15 years since thinning this tree has grown in diameter 2 inches more than it grew during the previous 28 years (Arkansas)

How should loblolly pines be thinned?

There are two methods of thinning pine stands. By one method, the smaller, stunted, crooked, and defective trees are removed from crowded stands, thus giving more growing space to the larger, more desirable, and more promising trees. This is known as low thinning, or thinning from below upward, and is illustrated in Figures 9A, 10A, and 10B. By the other method, the largest trees are cut out at each thinning and used, thus giving space to the remaining smaller trees to increase their rate of growth and development, and fill up the open spaces. This latter method, shown in Figure 9B, is known as high thinning, or thinning from above downward.

The first method, that is, thinning out the smaller, weaker-growing and defective trees, is generally regarded as the better, because the stand of trees is kept growing at approximately its fastest rate. It is

the method that should always be used in thinning young pines. In the second method, the growth is not kept at its fastest rate. The



FIG. 8.—A stand of well-spaced and rapid-growing loblolly pines. The trees are growing 2 cords of wood an acre a year. They are 21 years old and large enough to cut saw logs

production of timber per acre is noticeably slowed up because of the interval of time required by the formerly suppressed trees to recover from their setback and reach the healthy condition of

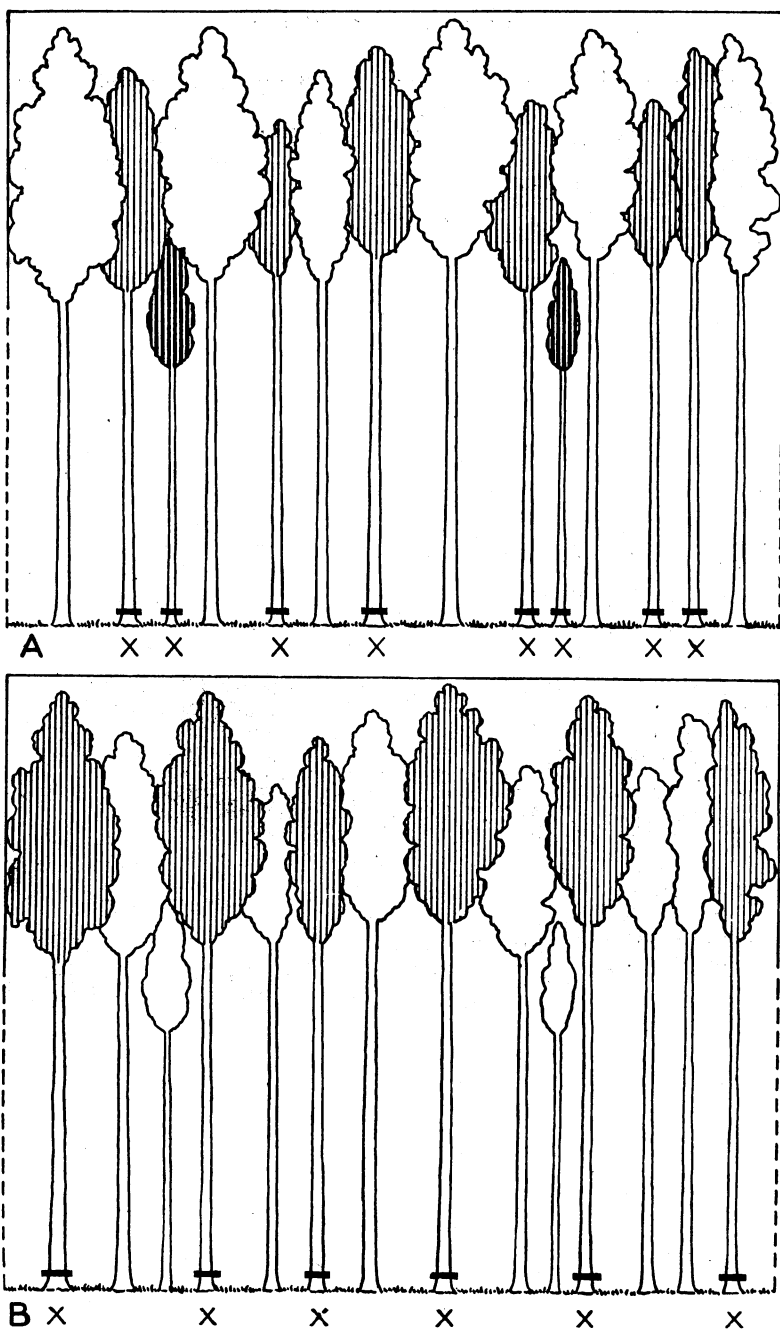


FIG. 9.—HOW TO THIN LOBLOLLY PINE

A. The low-thinning method removes the slow-growing and defective trees and utilizes them before they die from natural crowding. This increases both the growth and the value of the more vigorous trees. The method can be well used when the trees are even aged or came up at about the same time. The rapid growth of pines in the South is a great asset. (The shaded trees are marked to be cut.)

B. High-thinning method. The larger and more rapid growing trees are marked for cutting. This method is in common practice in the South, as it brings the owner early returns from the use or sale of timber. The method leaves the smaller trees that have become stunted. After the larger trees have been cut, usually two to four years will be required for the suppressed trees to recover and grow at a satisfactory rate. (The shaded trees are marked to be cut.)

growing rapidly. The method of favoring the most vigorous and best trees—the first described—produces large-sized material which always commands higher prices.



FIG. 10.—THINNING A PINE STAND

A. Spotting the trees to be cut in thinning a 20-year-old loblolly pine stand. For this purpose the use of whitewash or cheap white paint is suggested.

B. If the first thinning had been done five years ago, when the trees were 15 years old, the same amount of timber would have grown, but on fewer trees. The trees would therefore now have averaged several inches larger in diameter and have made more money value yearly.

How often should a thinning be made?

There is no set rule about this, but in general two or three thinnings in the life of the stand are desirable. If the first is made at

an age of 10 to 15 years, the second likely should follow in about 5 years, and the next in 5 to 10 years, or at an age of 20 to 30 years. This should be the means of developing good-sized trees for saw timber or piling. The trees removed in the thinnings should make firewood, pulp wood (fig. 11), poles, piling, and, from the last operation, saw logs.

How much timber should be taken in a thinning?

A good guide in this matter is to ascertain the number of trees, as shown in Table 1, that make up well-stocked stands at different ages. Much depends upon how close together the trees are at the start. Often more than one-third of the trees are best removed at an early thinning. This will amount to only from one-fifth to one-tenth of the actual amount of wood, or volume of the stand.



FIG. 11.—Pine products from the farm.—The market for sap pine for paper pulp wood is growing rapidly in the Southern States. It often makes possible the proper thinning of young stands at a good profit. Some owners are unwisely cutting their lands clean, because the paper mills are taking timber down to 4 inches in diameter. Instead they should leave several full-topped trees per acre to scatter seed and keep their timberlands working.

The early thinnings should be comparatively light, because otherwise the remaining trees will become bushy, rather than long and clear of stem.

If the aim is to grow fair-sized timber of fair quality, the plan might well be to produce a final marketable stand consisting of 200 trees an acre. This would give an average spacing of about 15 feet apart. The trees should be as evenly spaced as possible.

If trees of larger diameter are desired, the owner should thin the stand so as to give each tree a space of about 20 feet each way, or a total of 100 trees an acre. There is no hard and fast line known as to which spacing is the most profitable. This is something yet to be found out by research.

Is thinning profitable?

Thinnings often yield a good profit. They should, as a rule, at least be made to pay for themselves.

In eastern Maryland a farmer thinned a piece of loblolly pine that had come up on worn-out land 18 years before. He cut 11 cords per acre, which was marketed at a clear profit of \$1.05 per cord. He therefore cleared \$11.55 per acre, or about 65 cents per acre for each year that it was growing. The trees left to grow contained 16 cords per acre. If he had cut the land clean for firewood, the 27 cords would have brought in \$28.35 per acre, or about \$1.60 per acre yearly net profit. Such clean-cut land should be restocked by planting small trees.

A thinning in another loblolly pine stand, 33 years old, gave 2,762 board feet of lumber per acre. This sold for \$41.43 and made the owner a clear profit of \$20.72 per acre. On the land there were left 188 trees per acre which contained about 18,000 board feet. As a result of the thinning, the growth will be stimulated and another thinning will be possible in about 10 years.

The Forest Service recently received a letter from a farmer living near Norfolk, Va., who has thinned out his pine. He wrote:

In caring for a considerable acreage of loblolly pine I have taken out systematically each year all the trees that were crowding and have also taken out all the crooked and worthless trees of every variety, and have protected the whole from fire. The pine has made wonderful growth and is a real pleasure to look at. I have gotten enough out of the piling from trees that were crowding to pay carrying charges on the whole, and I think I can continue to do so.

Is it advisable to prune pine trees?

The pruning of loblolly pines is not, as a general rule, advised on a commercial scale. This is because of the cost of labor. If dead limbs can be broken or cut off at small expense the operation may pay the owner. Pruning produces clearer timber. Small trees should not be pruned of living branches. When the trees are 3 to 6 inches in diameter, the lowest "whorl" or set of living limbs may be cut off, provided the cost is no consideration. After a year or two the operation might be repeated with the next higher branches. A clean cut should always be made close to the main trunk. If the timber stands dense enough on the ground, natural pruning will take place, but large limbs often remain on the trunk for many years before being broken off by the wind or sleet.

CUTTING

When should the main timber crop be cut?

By the "timber crop" is meant the mature or final crop of timber. The earlier cuttings are known as thinnings. The age at which it pays the highest net return to cut the final, or mature, crop is not the same for all pieces of the same kind of timber. The market conditions have much to do with it, as also has the size of the trees.

Generally speaking, it is a mistake to cut a piece of loblolly pine under 25 to 30 years. Some owners are in a hurry to realize on their timber and cut it at 18 to 25 years for small saw logs, pulp wood, crossties, or firewood. In most cases they make a sacrifice in profit thereby, because their pine is growing then at about its fastest rate.

It would be unwise to withdraw money from a bank while it was drawing from double to triple the rate that it averaged over the whole period.

Good size and clear quality in lumber means, of course, greatly enhanced value. Hence it often pays the largest financial return to defer cutting the timber crop until it is 40 to 50 years old (fig. 12). The returns from the thinnings should add up to one-quarter or one-third as much as the value of the final crop. From various financial causes, including good conditions of the market, it often seems necessary and is likewise practicable to cut the crop at 30 to 40 years.

How should timber be cut?

The controlling aim in good cutting is to obtain a full stand of young pines on the cleared land as quickly as possible after logging. (fig. 13). The land should be kept continuously productive. Other



FIG. 12.—Good prices are being paid for pine logs. The farmer can often make good wages in addition to the price of his logs by cutting and hauling them to the mill or railroad.

considerations are of much importance, such as cutting low stumps and small or high tops in order to effect complete utilization of the timber.

The practice of good logging is illustrated in Figure 14, A, although the stumps should have been lower. Some bad practices in logging are well shown in Figure 14, B.

There is a vast difference between good and bad logging. The present money returns are greatly affected, but of as much or more consequence is the potential growing power, or the future earning capacity of the land.

What are some rules for good loggings?

1. Cut no sound, thrifty trees below 12 inches in diameter (at 1 foot from the ground).
2. Cut low stumps—12 inches or under—and save the best timber; also cut logs well into the top, although of lower grade.

3. Leave two to four bushy-topped thrifty trees per acre as seed trees. (This is often provided for by rule 1.)
4. Take care in all stages of logging not to injure the young timber.



FIG. 13.—CONTINUOUS FOREST PRODUCTION

A. This land was cut over by a large lumber company, which is developing its holdings for a permanent timber production. Its forester (on the left) and the local agricultural county agent are shown discussing fire prevention. A splendid second crop of trees is coming along under good methods of forest management.

B. A complete restocking of the land with young loblolly pines. The large trees, left in logging to reseed the land, have grown very rapidly and produced the owner a good money return. They may now profitably be cut.

5. Pull all brush away from living trees to lessen the fire risk and the menace of infestation by insects or "worms."
6. Keep out fires at all times.

GOOD LOGGING helps both buyer and seller.

It is often a mistake to cut small trees. Much of the wood goes into the slab and sawdust piles, and what is taken makes only a



FIG. 14.—GOOD AND BAD LOGGING

A. A good cutting of loblolly pine. Seed trees are left to reset the land and the young timber is left uninjured. The tops are pulled away from the trees to reduce fire risk and insect menace, but the stumps should have been cut lower.

B. Bad logging. This is a serious fire trap. Large logs were left in the tops and the brush is not cut and scattered away from living trees. On one measured acre the loggers left 1,080 board feet of the choicest timber in stumps above a 12-inch height. This would have paid for the cost of logging.

small scale of lumber which is of low grade and low value. Young trees are growing rapidly and usually making the highest net money return to the landowner.

The rule to cut no sound, thrifty trees under 12 inches on the stump must necessarily be modified at times to get the best results. In dense groups, smaller trees should be cut to open up the stand. Some smaller trees are cut to get rid of slow-growing, defective, and lower-grade trees. In places trees of larger size should be left to provide sufficient seed to restock the ground. On lands subject to washing, trees should be left for better protection of the soil.

The small sawmill operator (fig. 15) wastes timber in high stumps—above a height of 12 inches—sometimes enough to pay for the logging. In such stumps, he is leaving on the ground the highest grade and most valuable timber of the tree.

Since loblolly pine trees spring up only from seeds shed from the burrs in early fall, an ample stock of seed-bearing trees is a prime requirement for getting pines, instead of hardwoods, to restock the lands following logging (fig. 13, B).



FIG. 15.—Ground mill or portable mill. Small sawmills make a market for scattered and small lots of timber. Most of their operators are unnecessarily wasteful in their methods and the seller of the standing timber, along with the sawmill owner, loses money.

Trees should be thrown, so far as possible, into openings rather than into groups of young growth.

Tops or "laps" help to breed the southern pine beetle—particularly if left in summer piled against living trees. They should be cut for firewood or at least pulled out into openings so as to dry quickly. By carelessness in this matter many valuable trees are killed.

Fire is the arch enemy of the forest.

Is a timber-sale contract advisable?

It is important that a written agreement be drawn up and signed before any sale is completed. The specifications for cutting should be included as well as the price and method of payment. A full understanding and agreement on these points is essential and will help to avoid unpleasant controversies where the owner is desirous of leaving his timberland in good condition to produce another crop.

A suggested form of agreement will be found in *Farmers' Bulletin 1210*, "Measuring and Marketing Farm Timber."

Why do hardwoods sometimes follow pines?

Usually because of lack of enough seed for starting a new generation of pines, and because of repeated fires after logging. In the shade of the pines before cutting, there usually can be found small, stunted scrub oaks, hickories, gums, or sassafras. These generally are unnoticed. When the pines are cut away these hardwoods spring up, and especially is this so if fire runs over the tract and causes them to sprout. Young pines are easily killed by fire, but the hardwoods will sprout up vigorously following several burnings.

VALUE OF THE PINE CROP AND PROFITS

How much money does loblolly pine bring on the market?

The value of pine stumpage and lumber has been rising at a comparatively rapid rate. It is doubtful if the rise is equaled by any other farm-grown product. It is not likely to fall, but may go higher. The value of timber on the stump is the best basis for consideration, for while it changes, it fluctuates less abruptly than that of lumber.

In eastern Maryland, tracts have sold (in 1924-1925) for as much as \$10 per thousand feet on the stump (measured by the Doyle rule). In the Carolinas it is very common for such timber to bring \$5 per thousand. In the Georgia-Alabama region, second-growth, or sap pine, had very little value until about 1917. Since then prices on the stump have ranged mostly from \$3 to \$5 per thousand feet.

Pine for pulp wood, or paper wood, on the stump has brought the owner from about \$3 per cord in Maryland to \$1 a cord in the Gulf coast region. A piece of 20-year old pine near the paper mill in Jackson County, Miss., netted the owner \$2.50 per cord on the stump in 1925.

Peeled poles of standard sizes have sold around 5 to 8 cents per lineal foot for 20-foot sticks and up to 15 to 25 cents per lineal foot for 40-foot poles.

How much is the yearly growth on an acre of loblolly pine worth?

The value of timber on the stump varies widely with the size and quality of the timber as well as its accessibility to market. At a value of \$5 per thousand board feet on the stump, an acre of loblolly pine trees well-set and protected from fire that is making a yearly growth of 200 to 800 board feet is bringing the owner a gross return of from \$1 to \$4 per acre yearly. In Maryland where loblolly has brought as high as \$10 on the stump, the return has been \$2 to \$8 yearly.

How much is a crop of 1 acre of loblolly pine worth?

Assuming a yield of 22,100 board feet per acre, on average-quality land, for pine 35 years old, as shown in the third column of table 5 on page 11, and a present value of \$5 per thousand feet, the value of an acre of loblolly pine grown as a crop would be \$110, or an average return for 35 years of a little over \$3 per acre yearly. To this should be added an additional yield estimated as the equivalent of 5,000 board feet removed in thinnings worth \$3 per thousand feet, or \$15 per acre. (See p. 17.) This makes the total value of the products

from the acre \$125; or an average gross return of nearly \$3.60 per acre yearly.

Because stumpage values for timber include no labor for logging or sawing, the values are comparable to those of cotton, corn, or peanuts grown but unharvested in the field. If the logs are cut and hauled to the mill or railroad, as potatoes and cotton are harvested and delivered, they should be worth \$12 to \$18 per thousand feet. This would give for the final cutting, or crop of timber, estimated above at 22,100 board feet, a value of \$265 to \$397 per acre.

PROTECTION OF TIMBER CROPS

How much does fire injure timber?

So long as fire is kept out, the thick, spongy layer of pine straw and woods mould protects the roots of the tree against the injurious



FIG. 16.—Pines grow rapidly when protected. Loblolly pine on land that has never been turned over. The trees are 21 years old and ready for saw logs. A church camp-meeting ground is near by, which accounts for the protection of the land. The leaves, or straw, form a thick mat which prevents rapid drying of the soil. Thus the trees get needed water in dry times and keep up a rapid growth.

effects of drought and midsummer heat. When this thick layer of mulch is removed by fire, the trees' vitality and their growing power are known by numerous tests to be greatly lessened, and the result is slow growth of the trees and frequent and severe attacks by insects and fungous diseases (fig. 16). One old field stand of loblolly pine was raked for many years on one side only of a dividing road. Of two adjacent acres, each with the same number of trees, the one raked yearly for straw had a stand of 18,600 board feet and the other with its accumulated straw and litter had 24,800 board feet. The trees were 55 years old, and the straw had added over \$1 an acre yearly in value of the growth.

Fire yearly kills many millions of young saplings, amounting to a heavy financial drain upon the country. Open ragged stands of pine trees yield only a fraction of that yielded by well-stocked stands.

STOP BURNING THE WOODS

FIRES!—Kill out the pines

- Make scrub hardwoods sprout
- Run the game away
- Keep the soil poor
- Kill carpet grass, lespedeza,
switch cane

TIMBER GROWING CREATES WEALTH

The bulk of our young pine forests of the South are only partially stocked as a result of repeated fires.

Great areas of the best producing timberland are yearly turned into a man-made desert through carelessness in logging and a mistaken idea of burning to get early grass. For a little early range worth perhaps 10 cents an acre, the timber-growing power of the land, worth \$3 to \$5 an acre yearly, is often destroyed by burning up all the young trees.

It is well to remember that when timber burns everybody loses.

Do insects cause damage?

The southern pine beetle attacks living trees whose vitality is weakened by various causes, chiefly injury by fire. The adult is a small dark brown beetle. In the soft inner bark of the tree it lays eggs which hatch into grubs, often known as "worms." These feed on the rich living layer of inner bark and new wood, thus girdling the tree and causing its death. Fortunately the life history of this insect has been found out, and simple and easily applied information for checking its depredations can be obtained by applying to the State entomologist or to the Bureau of Entomology, United States Department of Agriculture, Washington, which has issued a circular on "The Southern Pine Beetle" and distributes it free upon application.

The pine sawyer is a large beetle whose larva, or white grub, bores into the sapwood of dead or felled timber. Its activity may be checked by peeling and drying the timber, or immersing it in water.

Young loblolly pines are sometimes injured by the Nantucket tip moth which attacks the tender young shoots in the early summer. These shoots are often killed, and as a result the tree becomes somewhat deformed and its rate of growth is slowed up. Most trees outgrow the attack successfully. No practical means has yet been found

for checking this insect. The references given above should be used in seeking further information upon this important subject.

Are pine trees subject to diseases?

Second growth, or sap pine under 50 years is little affected by "red heart" or other fungous diseases. Wounds caused by fire admit the spores, or "seeds," of fungi but the vigorous young trees are able to combat them successfully, as a rule. Probably the antiseptic qualities of the crude turpentine, or gum, help in this matter. After the tree reaches middle or more advanced ages, red heart is not an uncommon enemy, gradually eating away the heartwood and thus weakening the tree as well as destroying the value of the affected

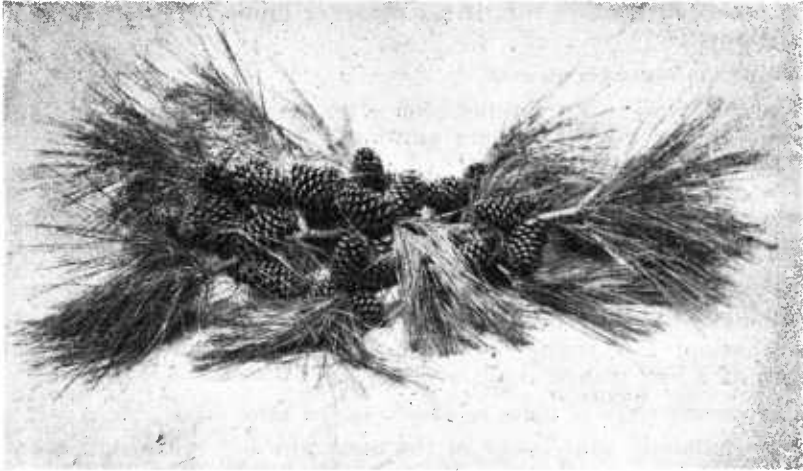


FIG. 17.—Loblolly pine produces burrs freely and from these come the seeds. The burrs often remain on the branches for several years

wood. The best protection is to keep out all fires and cut and utilize trees as soon as they show the "bumps" which are good indications of the presence of disease.

Other diseases and insects known to attack loblolly pine are generally of lesser importance.

REFORESTATION BY NATURE

How do pine trees start?

The burrs on pine trees produce seed from which the next generation of trees grow (fig. 17). The loblolly pine, unlike the true short-leaf yellow pine, very rarely sprouts from the stump. Small trees therefore come only from seed, or mast. In order to obtain early natural reforestation of loblolly pine following cutting, there must be trees of seed-bearing age on the ground or near by.

At the base of each scale of a ripe burr will be found two seeds. Near the top and base of the burr the seeds are often undeveloped, or abortive, but the seeds in the central portion are usually plump and fertile. Usually about 60 out of every 100 seeds are good, or fertile.

The seeds are small—there are about 20,000 of them to a pound after the wings are removed—and they fly long distances on a strong wind. This in part accounts for so much young loblolly pine on former long-leaf pine land.

How often does loblolly pine produce seed?

It produces seed freely, bearing full crops about every third year and often one or more partial crops during the interval. The burrs require two seasons of growth to ripen the seed, so that frequently two crops of burrs are on the tree at the same time. The old burrs frequently cling to the branchlets for two to four years. They close in wet weather but normally open afterward and remain so during dry weather. Loblolly can often be distinguished from other pines by a glance at the tree top, if the observer knows the size and shape of the burrs.

When do the seeds germinate?

The seeds fall to the ground soon after the burrs mature and open, usually in the middle or late autumn. As a rule, they germinate early the following spring.

The slash pine, an associated tree in part of its range, has a seed of about the same size, but it germinates mostly in the same autumn, from two to three weeks after it falls. The young seedlings of the two pines look somewhat alike. They also have about the same form of root development, which is very different from that of the long-leaf pine with its long, stout taproot. In one season after germination, the young loblolly seedling commonly grows to a height of 5 to 8 inches.

Can successive crops of pines be grown on the same land?

Yes. Loblolly pine is one of the most prolific seed producers and one of the easiest of our pines to grow successively on the same land as a crop. Nature must, however, be given a chance, which means, in brief, that there must be trees on the land to produce seed, and that fire—the destroyer of the forest—must be kept out.

Thus, loblolly pine comes back well after logging. Numerous cases may be cited where the loggers have come back two or three times at intervals of 10 to 15 years and each time obtained a good cut of second-growth timber. This does not mean that they cut trees 10 to 15 years old, but in the interval the trees that were left have grown to merchantable sizes and the openings have reseeded successfully.

If rightly managed, our loblolly pine lands would all be heavily reset with pine trees and making a rich profit for their owners. Many visitors from European countries, where timber growing is about as well understood and practiced as the growing of food crops, have remarked upon the great possibilities of our loblolly-pine growing sections in the southeastern United States.

SOWING AND PLANTING LOBLOLLY PINES

Is it ever desirable to reforest land by hand methods?

Years ago, when there were many old or original pines scattered along fence rows and pieces of big timber standing near cleared fields, abandoned farm lands were almost always quickly covered by dense

pine thickets. Some of these thickets were "so dense that a rabbit couldn't run through them." In spite of popular belief that heavy seeding still goes on everywhere, much of our timber is being cut to such a small diameter that at best only a few scattering immature trees are left. For lack of sufficient seed, vast areas of recently abandoned fields and cut-over lands are coming up to broom sedge and only a few bushy pines, with perhaps some sweet gums and sassafras.

Many fields that were cleared and worked when labor was cheap no longer yield a profit from farming. Because of the high value of timber products of all kinds, it is now practicable on the less tillable soils in the South to plant and grow crops of pine timber.

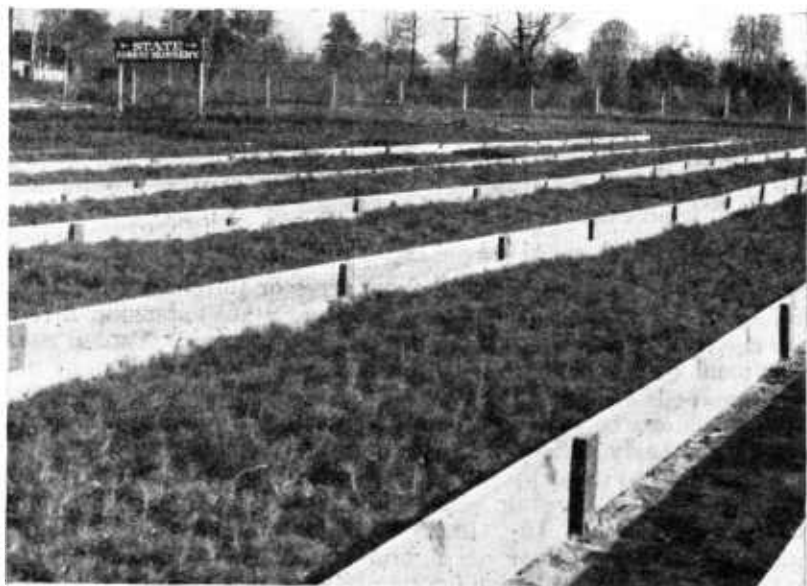


FIG. 18.—One-season-old loblolly pines ready for planting. Several million trees have been grown here in the State forest nursery of Maryland. Most of the State forestry departments are growing large numbers of seedling trees for reforesting land.

How can pines be started on open lands?

Loblolly pine has been successfully started by setting out small seedlings, much as cabbage or tobacco plants are set. The method of sowing the seed directly in the fields or woods has not succeeded well, as a rule. Our knowledge of how to sow seed or plant young trees successfully in the South is limited, and the subject is under careful investigation by the States and the Federal Government.

Where can seedling pine trees be obtained?

Small pines suitable for planting are grown under the supervision of the State forester in some of the Southern States (fig. 18). Where there is no State department or commission of forestry, under the stimulus of the Clarke-McNary forestry law (enacted in 1924) some States have begun growing small trees for reforestation purposes at the colleges of agriculture. These are distributed free or at small cost to the public. A few private nurserymen handle small trees of

Idle lands impose oppressive burdens
upon other property and upon public
welfare.

the southern pines for forest planting. The demand and supply are very uncertain, so that at the present time (1926) it is practically necessary to grow your own seedlings. It will likely not be long until an abundance of trees for reforestation can be purchased at fair prices from State or private nurseries.

How can pine seed be obtained?

Seed, or mast, can be gathered from trees or purchased from commercial tree seedsmen. The State forester, State extension forester (with the college of agriculture), or the Forest Service, United States Department of Agriculture, will furnish, upon request, lists of dealers in tree seeds and seedlings.

Pine seeds can be easily gathered by pulling off the ripe burrs, or cones, in the early fall, just after they turn brown and before they dry sufficiently to open up. The best place to get them is from the tops of trees cut in logging. The burrs may be collected in buckets, tubs, or gunny sacks (fig. 19, A and B). They should then be spread out on a dry floor or in bins (fig. 20). When thoroughly opened up, they should be beaten or vigorously raked about until all the seed are shed. Figure 19, C, shows a practical means of shaking out the seed.

The wings can be removed by beating the seed in a sack or rubbing them over a wire screen. The broken wings are readily separated by winnowing the seed in a moderate wind.

How many trees should a pound of loblolly pine seed produce?

The 20,000 seeds in a pound of loblolly seed, if sown in nursery beds should produce from 5,000 to 7,000 good seedlings. More than this may be expected if the seed is high-grade and the nursery practice good. With an average germination of about 50 to 60 per cent of the seed, and some inevitable loss of the young seedlings, the number of one-season-old trees that may be expected from a pound of loblolly pine seed is thus about one-third of the original number of seeds. As with any garden or field crop the results will be variable.

How can you grow pine seedlings?

Small pines for planting out can be grown in nursery or garden beds (fig. 21).

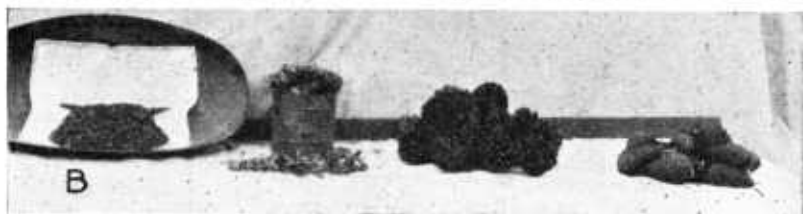


FIG. 19.—LOBLOLLY PINE SEED

A. The burrs are being pulled from the tops of trees felled in logging. They are ripe when they begin to turn brown in the late summer or early fall. Buckets, tubs, or gunny sacks may be used as containers.

B. A bushel of closed burrs (a few shown on right) will usually yield about 1 pound of cleaned and winged seed (shown on left). In the other pine are some opened burrs and a can of seed before the wings are removed.

C. After the burrs are dry and wide open the seed can be rattled out. A practical device is shown here. It consists of a packing box with two sides covered with half-inch mesh wire cloth and made to turn around in a shaft placed in an eccentric position.

(Photos by Maryland State Department of Forestry)

Two kinds of seed beds are in general use. The kind shown in Figures 18 and 21, B, has a frame of 1 by 12 inch boards set about 2 inches in the ground. The soil should be from 1 to 2 inches higher inside than outside. The other type of seed bed is surrounded by a curbing, consisting of 1 by 4 inch boards, set about 2 inches in the ground and holding the soil in the bed an inch or two above the general level. The latter kind permits better ventilation, often needed by the seedlings when very young.

In the early spring, one-half pound of loblolly pine seeds (10,000) should be sown broadcast on well-worked sandy soil in a bed 4 feet wide by 12 feet long. Two such seed beds should therefore be made for each pound of seed to be sown. If possible, the soil should be thoroughly worked the fall before.

The seeds, after being sown in the seed bed, should be pressed into the loose soil and covered by a layer of burlap or a thin sprinkling

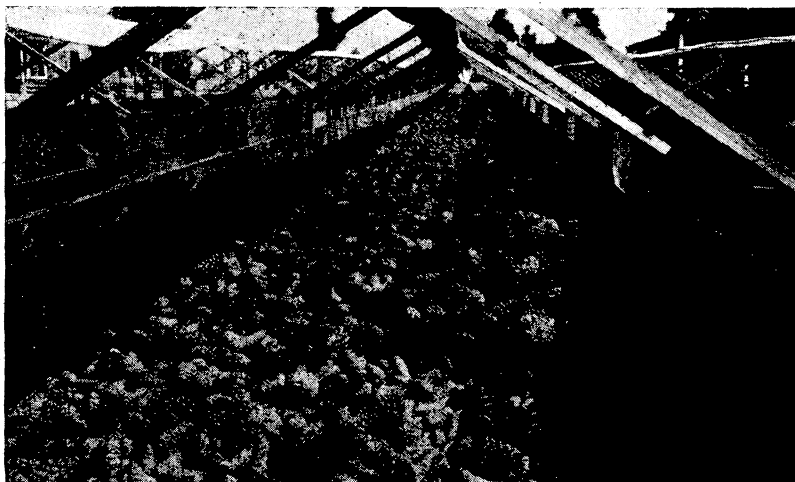


FIG. 20.—In this seed-preparing operation by a large lumber company drying bins with tight floors and sides were used. They are raised about 18 inches above the ground. The loblolly pine burrs are raked over to hasten drying and later to shake out the seed. The seeds fall through screened openings in the floor into boxes placed beneath.

of fine sand, or better, vegetable humus or litter as free as possible of weed seed. The latter should not be over one-eighth inch in depth. Old garden soil is undesirable as it usually contains weed seed and spores, or "seeds," of a damping-off fungus that is a serious disease upon tender pines. The best soil is acid soil from new land or from the woods. A layer of burlap holds the heat and the moisture in the soil to a good degree. It should be removed without fail as the seed begin to germinate.

Since protection against birds and rodents is necessary, when burlap is not used the bed should be covered with $\frac{1}{2}$ -inch mesh builders' cloth fastened over light frames, 4 by 6 feet in size. The seed should be watered during all dry spells and kept continuously damp during the sprouting. This is absolutely necessary for good results.

The pine seeds should sprout in the spring in about two to three weeks of favorable growing weather. The seedlings may be expected

to reach heights of 6 to 9 inches in one season. They are then large enough and satisfactory for all average planting.

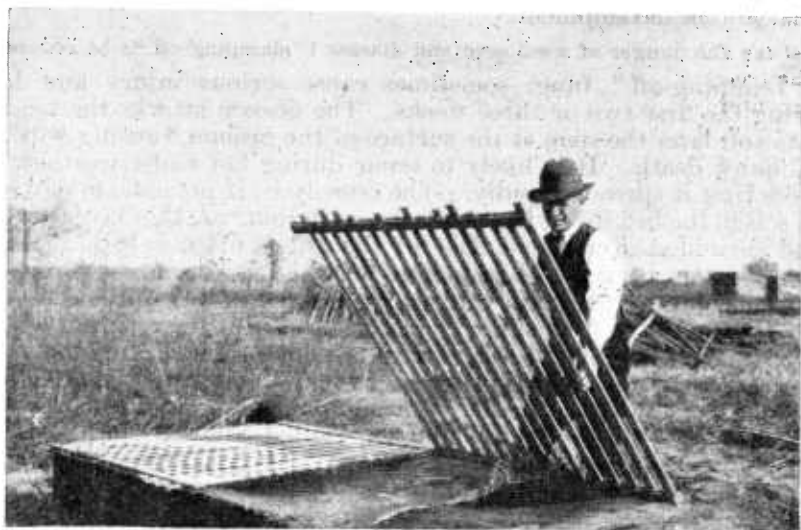


FIG. 21.—A. If watering can not be done freely during dry periods, one-half shade should be given the pine seedlings during midsummer. The frame shown is 4 by 4 feet, made of 20 laths, and three sections would be required for a 4 by 12 foot bed. Another method is to use two sections, each 4 by 6 feet, and made of light strips of lumber.

B. A farmer weeding a bed of 3-months-old pine seedlings. The bed is constructed of 1 by 12 inch boards, and is 4 feet wide by 12 feet long. The two lath shade frames have been removed.

If, however, the land to be reforested is unusually unfavorable for tree growth, it should be set with sturdier or hardier trees. These may be developed by transplanting the little pines, after one season's

growth in the seed bed, into transplant beds and spacing them about 2 inches apart in rows spaced about 6 inches apart. After one season in these beds they are ready for planting. They have the advantage of large root development.

How can the danger of weed seed and disease ("damping-off") be reduced?

"Damping-off" fungi sometimes cause serious injury and loss during the first two or three weeks. The disease attacks the tender roots and later the stem at the surface of the ground, causing wilting and quick death. It is likely to occur during hot moist weather, at which time it spreads rapidly. The remedy is, if possible, to dry out the soil in the bed by giving it better ventilation. A thin layer of dry sand sprinkled over the surface of the soil is often helpful. Lime should never be used. The spores of this fungus are present in almost all old gardens and cold-frame beds; it is therefore advisable to make the bed in new soil or to bring such soil in for use in the bed.

Tests are being made of various chemicals for killing out the damping-off fungi and also weeds. Different soils appear to require different treatments. Further information can be obtained by writing to the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C.

Do pine nursery beds need attention?

It is very necessary to keep the little pines well weeded. If the weeds are not pulled when small, the pines are likely to be injured or pulled out in the weeding process.

During all dry weather water should be applied at intervals, gently and evenly over the bed. A thorough watering once in two or three days is far better for the seedlings than a light surface wetting every day. Furthermore, it requires less time.

During the summer, if good watering arrangements are not provided and used, the pine seedlings will require partial shade from the sun (fig. 21, A). Each bed should be protected with two sections of lath screen, each 4 by 6 feet. The shade frames can be made of 1 by 2 inch strips, with proper bracing, covered with laths spaced about 1½ inches apart. About 50 laths will be required for the two sections. This construction will afford one-half shade. The frames should be supported at a height of about 18 inches above the ground by three cross bars resting on stakes. The frames should be strong enough to stand necessary handling.

If water is applied freely during all dry periods, the shading is unnecessary. Large numbers of little trees growing in a small space require much water during dry spells.

When is the best time for planting out pines?

In the late winter and early spring before the buds begin to swell the conditions are most favorable for planting pine seedlings. Late fall planting may give good results if the season happens to be wet and the winter mild, but much injury may be expected during a dry fall and during a severe winter, because of frequent or hard freezing and also the resulting upheaval of the soil. If planted in the late spring after the new growth has started, pine seedlings are very likely to die.

How should small pines be dug up?

The roots of pine seedlings should be kept moist at all times, and never allowed to become even a little dry. The seedlings should be dug up carefully, the soil falling from the roots gradually so as to cause the least possible injury to the rootlets (fig. 22, A). The



FIG. 22.—A PINE TREE NURSERY

A. Digging, or "lifting," pine seedlings from the nursery beds where they have grown for one season.

B. The soil is allowed to drop from the roots. The stems and roots of the seedlings are wrapped in wet moss and burlap, and the bundles packed in crates for transportation to the planting areas.

trees are then tied in bundles of 50 to 100. If the taproots are long they should be pruned back to about 8 inches in length, using a large, sharp knife and a board. If planting is to be done near by or soon, the bundles of trees are kept in water in tubs or buckets, or in wet moss or wet burlap (fig. 22, B). If not, they should be "heeled"

in fresh soil. To do this, a trench is dug in a shaded or cool location with one sloping side, preferably sloping toward the north. The bundles of trees are laid close together, and the roots and stems, but not the leaves or tops, are then covered with fresh soil, which is then firmed down. If exposed to sunlight the tops should be covered with one thickness of burlap or some brush, and if the soil becomes dry it should be well watered. In this manner seedlings may be safely kept for weeks up to the time when growth begins actively.

How many loblolly pines should be planted on an acre?

The common practice at present is to plant loblolly pine seedlings about 6 feet apart each way, or 1,210 per acre. This is advisable in order to get the pines to shade the ground completely at an early date. As a result of early crowding, the trees tend to grow with tall, clean stems. This is especially desirable with loblolly pine, which has a strong tendency to branch or "bush." Closer planting, for example, 5 by 5 feet apart, requiring 1,742 per acre, would effect complete shading earlier but would be more costly. On thin soil subject to washing, the 5-foot interval for planting will often be advisable.

How should small trees be planted?

The essentials of good planting are (1) to keep the roots wet; (2) set the tree with its roots spread out in a natural position; (3) firm or pack the soil in the hole; (4) set the tree a little deeper than it stood in the nursery or field; and (5) draw a little loose soil or leaf litter around the tree as a mulch over the soil.

It is desirable before planting to break the ground with at least a single plowed furrow. Two or three furrows close together are better but more expensive and, therefore, often inadvisable. Six feet is a standard width between furrows.

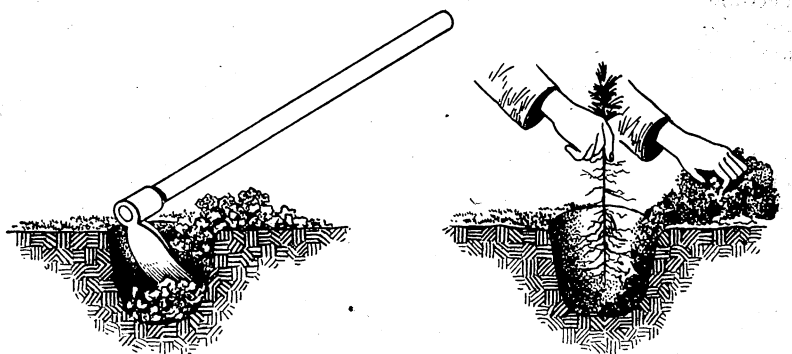
If the ground surface is entirely open or clear, check furrows 6 feet apart may be made without much cost. The trees are set at regular intervals in the furrows or in the checks. Two men make a good working unit, one digging the holes, the other setting the trees, which he carries along in a bucket containing water and preferably a clay puddle for coating the roots and rootlets.

In rough land, the furrowing may be impracticable. Then the trees may be set at approximately even distances apart, advantage being taken of favorable locations, in small openings, in natural soil pockets, close by old logs or stumps, and away from heavy shading bushes or trees.

A mattock ("mattox" or "mattax") is a good digging tool. Some grubbing hoes have a blade that is not too wide and therefore suitable (fig. 23, A). A narrow spade may do well, especially a tiling spade. The hole should be large enough to allow of spreading the roots, including the main taproot, in a natural position (fig. 23, B). If the main roots are left bent upward in the hole the trees soon die. The planter should hold the tree in a natural position, slightly lower than it formerly stood in the plant bed, and gradually fill the hole by drawing fresh soil in around the roots, meanwhile pressing the soil about the roots with the hands and at least twice with the sole of the shoe (fig. 23, D). A test of good planting is to

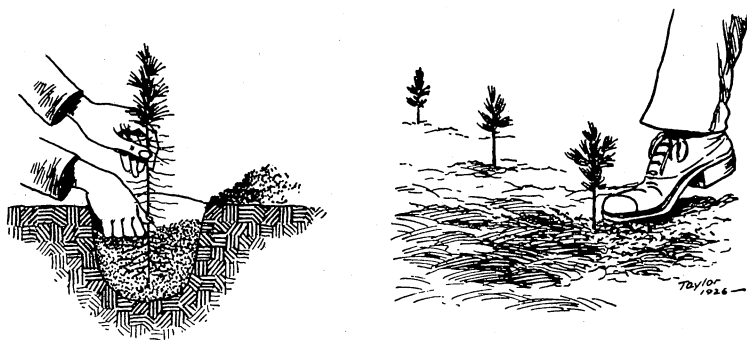
pull upward on the stem. The tree should be firm with no upward "give" to the main stem. Some loose soil or leaf litter should be drawn about the tree to act as a mulch in preventing rapid drying of the soil.

In loose, sandy soil, planting can often be done successfully and cheaply with a dibble. This tool, shown in Figures 24 and 25, is a



(A) DIG HOLE LARGE ENOUGH TO SPREAD THE ROOTS

(B) PARTLY FILL THE HOLE AND PACK THE SOIL



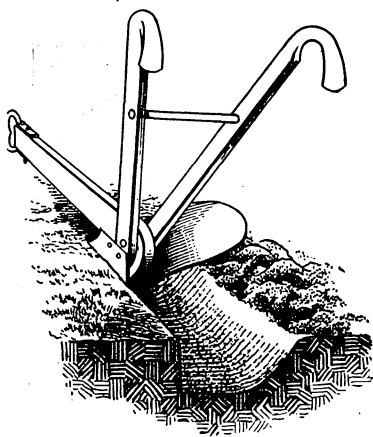
(C) PACK THE SOIL TWICE BEFORE FILLING THE HOLE

(D) FIRM THE SOIL WITH THE SOLE OF SHOE. SCRAPE LOOSE SOIL OR LITTER OVER SURFACE

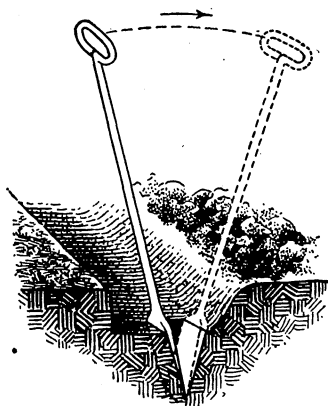
FIG. 23.—How to plant small pines with a grub hoe or a mattock. Where the land is not furrowed the planting may be done as shown here. The dibble may be used as well here as in furrows

narrow, thin, flat iron blade of $\frac{7}{8}$ -inch iron, tapered to a rounding point and attached to an iron rod as a handle. The blade is thrust into the soil, worked back and forth by the leverage of the handle, and removed. The tree is set and held in position in the slit by one man, while the dibble is thrust by the other man into the soil a few inches away from the tree and the slit closed by a thrust of the

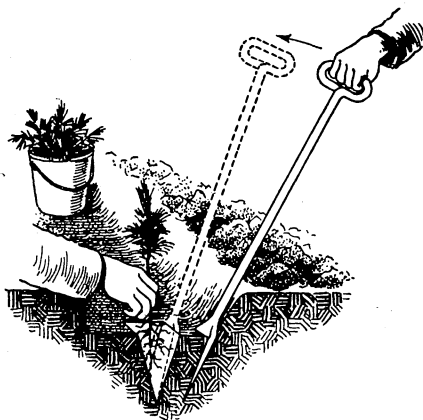
handle. Some loose soil or litter might well be scraped over the second slit. In a large commercial planting operation by a lumber company in southeast Louisiana the dibble has been the standard



(A) PLOW FURROWS 6 FEET APART



(B) OPEN A SLIT IN THE FURROW WITH A DIBBLE



(C) HOLD TREE IN THE SLIT WHILE THE OTHER MAN CLOSSES IT



(D) COVER UP SECOND SLIT WITH SOIL OR LITTER

FIG. 24.—How to plant small pine trees with a dibble. This is a rapid method, requiring two men, or a man and a boy. One uses the dibble and the other carries the bucket of trees and holds one at a time in the slits. The method is adapted to sandy or open soil. Also, it leaves the natural litter as a mulch

planting tool for several years. The planting is done with it in the bottom of a single furrow.

After the workers get a little used to the planting, a crew of two men or boys (fig. 26) working in loose soil should set out from 900 to 1,200 trees, or up to an acre in a day. It is well to "change about" occasionally between making the hole and setting the trees.

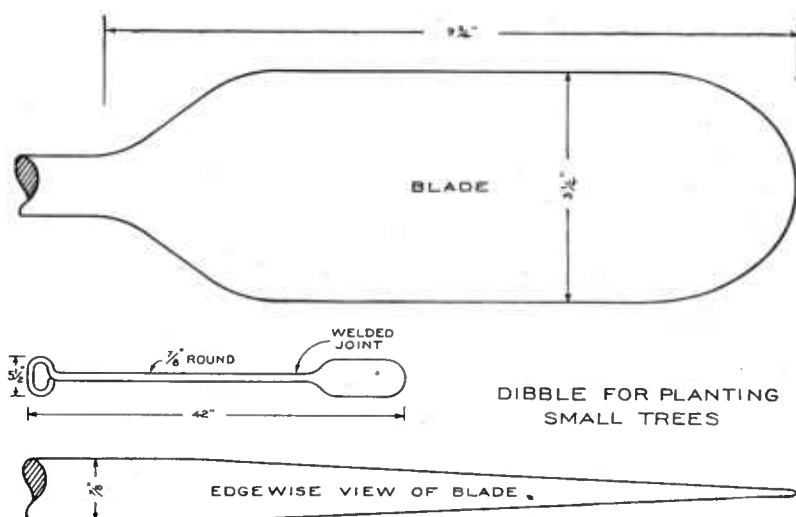


FIG. 25.—A good tool for planting small forest trees is the dibble. The blade is 3 by 10 inches and tapers in thickness as shown from seven-eighths inch down to an edge. The handle is of seven-eighths-inch steel and welded to the blade.



FIG. 26.—Planting 1-year-old loblolly pines 6 feet apart in furrows spaced 8 feet apart. This method generally has given better results than sowing the seed where the trees are wanted.

Do planted pine seedlings need any further attention?

It is very necessary to protect the trees from all burnings and from grazing stock (fig. 27). A few head of cattle, mules, or horses will do some damage. No stock should be allowed during the first five years at least, and even after that they should not be close herded.



FIG. 27.—Land reforested by direct seeding. A tract of several hundred acres in Louisiana successfully reforested by raking a few seeds in spots along plowed furrows. The trees are now 4 years old.

Watering or cultivation of the trees is generally regarded as impracticable from an economical standpoint.

The loss of a few trees in a forest plantation is not an uncommon experience. The cause may be poor grade of tree stock, or unusual periods of drought at the time of planting or shortly afterward. If any considerable loss occurs, it is feasible to reset the blank places the next spring or a year later.

Loblolly pine, when looked after as a crop, will grow an average of 1 to 2 cords of wood per year. The trees will be large enough in 15 years to make poles, pulp wood, or firewood, and in 20 to 25 years to make framing lumber. Except when cut as thinnings, the trees will yield more profit if allowed 10 to 15 years additional growth.